Estimating the ecological status and blue carbon stock of the *Posidonia oceanica* (Linnaeus) Delile, 1813 meadows of northeast Corfu Island

Declaration of conflict of interest:

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this report.

Funded by: Supported by:

Introduction

REPOSIDONIA

The project REPOSIDONIA, is one of the main projects, that falls under the scope of the Vulnerable Species pillar of iSea, it is an umbrella project that aims at the protection and the preservation of the habitat that *P. oceanica* constitutes to the point it fulfils its ecological role in a healthy marine ecosystem. Through the REPOSIDONIA project, iSea aims to contribute to the management and protection of the *P. oceanica* seabeds in Greece, as it is an one of the most important habitats in the Mediterranean, and provides nursery and hunting grounds for many species (Pergent *et al*. 2016). To achieve this, the project has five main thematic units of activities (i) increase the scientific knowledge about the distribution and coverage of *P. oceanica* meadows in the Greek Seas (ii) conduct biodiversity surveys and health assessments for the meadows (iii) estimate the mapped meadows' Blue Carbon potential to propose science-based management measures, and finally, (iv) educate and sensitise key stakeholders to propose target management actions for these habitats, highlight the important ecosystem services offered by the meadows. In the context of the project, iSea visited the Erimitis peninsula in 2021 and mapped the *P. oceanica* meadows in the region and conducted distance samplings to assess the local species composition. For 2022, iSea's team visited the site again to collect data and samples from the plants and the sediment beneath them, to quantify the health of the meadows and estimate the total Blue carbon stock stored in their substrate.

P. oceanica (Linnaeus) Delile, 1813

Fig.1: *P.oceanica* meadow in Erimitis bay

Biology

Posidonia oceanica, is a phanerogam plant that lives in the marine environment and is endemic to the Mediterranean Sea (Boudouresque *et al*. 2006). Also known as Neptune Grass, it is one of the most common species of seagrass (Magnoliophyta) in the Mediterranean, along with *Cymodocea nodosa,* and *Zostera marina*. *P. oceanica* has the largest size among Mediterranean phanerogams (Traganos *et al*. 2018). The plants consist of creeping or erect stems usually buried in the sediment, called rhizomes. Rhizomes also have roots that can grow to 70 cm beneath the surface of sediment. Its leaves form all year around and live between 5 and 8 months. The length of its leaves reaches up to 1.2 meters and their density can reach up to 10,000 per square meter (Díaz-Almela & Duarte, 2008). In Greece, Neptune's Grass is present along the majority of the mainland coasts and the Greek islands. In the Northern Aegean Sea, its meadows can extend down to 25 meters, while in the South Aegean Sea to 35 meters, depending on many factors but primarily water clarity. In the Ionian Sea, a highly oligotrophic area, the meadow can reach depths of 45 m depth (Traganos *et al*. 2018).

Importance

The endemic species *Posidonia oceanica* is the most important seagrass in the Mediterranean Sea (Boudouresque *et al*. 2006) in fact along with the Coralligenous habitats is the most important Mediterranean marine ecosystem (Giakoumi *et al*. 2013). The role of *Posidonia oceanica* meadows in marine coastal environments is often correctly compared to that of the forest in terrestrial environments, as they constitute the basis of the richness of coastal waters in the Mediterranean Sea. By producing enormous quantities of vegetal biomass, the meadows form the basis of many food webs (McRoy & McMillan, 1977). This primary production is comparable to or greater than that of other high - production environments, whether terrestrial or oceanic (Fergusson *et al.* 1980). In addition, *P. oceanica* meadows constitute a spawning ground, a nursery or a permanent habitat for a lot of species (over 400 different plant species and several thousand animal species populate the meadows of which many commercially important species; Pergent *et al.* 2016), making these underwater meadows a unique biodiversity hotspot (Boudouresque *et al*. 2012). Furthermore, *P. oceanica* is considered a "ecosystem engineer" as it stabilises the sediment with its roots and changes the hydrodynamic status of the sublittoral zone and protects from erosion (Pergent *et al*., 2012). Besides, it serves as a purifier as it improves the water quality by reducing particle loads (Hemminga and Duarte, 2000). Moreover, the plants produce large amounts of atmospheric oxygen, while also removing atmospheric CO_2. Through this process the meadows can store large amounts of organic carbon, serving as long-term carbon storages (Pergent *et al*. 2012). Finally, their rhizomes concentrate radioactive, synthetic chemicals and heavy metals, recording the environmental levels of such persistent contaminants. Hence the importance, *Posidonia oceanica* is also used as a 'biological quality element' in the long-term monitoring programmes of the Water Framework Directive (WFD 2000/60/EC) as an indicator for assessing the ecological status of coastal water bodies.

Protection status

Posidonia oceanica meadows are a protected habitat in the EU through a variety of Conventions, Directives and Regulations, at union or state level (See Table 1). Under most frameworks, fishing with dynamic gears, over the meadows, is prohibited, in order to prevent physical damage to the meadows (Pergent *et al*. 2016). Yet more legally binding measures aiming for its protection, should exist as more than half percent of the threats is associated with other human activities apart from fishing, such as

coastal development and the impacts it might induce to these precious ecosystems (Díaz & Duarte, 2008).

Table 1: Legal Frameworks for the protection of *P. oceanica* (Díaz & Duarte, 2008; Boudouresque *et al*. 2012; Pergent *et al.* 2016)

Region	Legal Framework
International legislation	Bern Convention Annex I (Council Decision 98/746/EC)
International legislation	Barcelona Convention, Annex II (2102/2015/EC)
International legislation	RAMSAR Convention
EU legislation	Fisheries policy regulation: 1967/2006/EC
EU legislation	UNEP-MAP-RAC/SPA 2009 (strictly protected in Mediterranean EU MPAs)
EU legislation	Habitat Directive (92/43/EEC)
EU legislation	Marine Strategy Framework Directive (MSFD, 2008)
EU legislation	Water framework Directive (2000)

Threats

Posidonia oceanica is a long-living plant with an extended Area of Occupancy and Extent of Occurrence and hence listed as Least Concern by the latest IUCN assessment, although its population trend is estimated to be decreasing in its full extent (Pergent *et al.* 2016). The extremely slow growth rate of the plant, makes it highly vulnerable to external disturbances, thus making it very difficult to recover if degraded. In the Mediterranean basin, there has been a decrease in *P. oceanica*, up to 10% in the last 100 years, but recent analysis of its coverage shows an even steeper decrease of 34% of the area covered by it, in the last 50 years (Boudouresque *et al*. 2009). The main threat to these meadows is habitat degradation by human activities, such as: Water pollution, Construction of coastal

infrastructure, Modification of marine currents (hydrography), Fishing, Invasive species, and shipping (Boudouresque *et al.* 2012). The most destructive anthropogenic behavior for Neptune grass is uncontrolled anchoring over the meadows, which causes immediate damage and reduces the coverage of the meadows, especially in areas with high tourist traffic (M0ontefalcone *et al.* 2010). In Greece, conservation actions are limited in local projects and in the two Greek MPAs (Zakynthos and North Sporades islands) (Pasqualini *et al*.2005; Ladakis *et al*. 2003). In Corfu Island, information about the spatial extent of the seagrass meadows is poor, with only two areas been model mapped: Between Othonoi island and Mathraki and from Perama to Ag. Ioannis, whereas there is no available information about their health status (EUNIS Marine Habitat Classification, 2019). Both areas are part of the NATURA2000 network (Sitecodes: GR2230010 and GR2230005). The standard data form (SDF) for GR2230005 includes *P. oceanica* meadows as a habitat that covers 367.633 ha while no habitat types are included in the SDF for GR2230010.

Study area

Erimitis peninsula is located in the Straits of Corfu, a narrow body of water between the coasts of Albania and Greece (Northeast Corfu), that separates the two countries. The channel is a passage from the Adriatic Sea on the north to the Ionian Sea. It is worth mentioning that the mainland area across Erimitis shores is the Butrinti National Park, an UNESCO World Heritage Site. According to the Butrinti National Park report in 2010, the *P. oceanica* meadows there cover 374.8 ha, comprising 3.98% of the area and hosting a variety of fish species and marine megafauna (Zotaj, 2010). The region of Erimitis includes seven beaches that are intact from human disturbances from the land, as the beaches can only be approached by trails or from the sea. iSea's team has visited the site in 2021 to conduct the necessary fieldwork in order to map the meadows within the study area and document the local biodiversity they host. The study area has a total surface of 25.4 hectares with a maximum depth of 43 meters and is characterized by an extended rocky shore, with isolated small sandy beaches. The sediment of the study area is a mixture of rocks, gravel and sand. The mapping was conducted by divers swimming along the meadow borders, with a buoy attached followed by the boat. The principal investigator of the team was marking the edges of the meadow by taking the coordinates of the divers' buoys. These coordinates were then imported to a GIS software and the points were then merged to compile a polygon cohesive polygon. This polygon was corrected using data from known patches where *P. oceanica* was absent (Fig.). The mapping output was a polygon of a total 15.7465 hectares, covering 61.84% of the study area. The shallowest borders started at 0.2m, indicating undisturbance and overall good health (Montefalcone *et al*. 2010), and the deepest borders reached depths of 42m, in the central part of the study area, albeit most edges reached the 20-meter bathymetric contour, likely due to limited light availability. Although seagrass meadows may be naturally fragmented by waves, currents, and colonization processes into patches of different size and form (Pace *et al*. 2017), the monitored meadow seemed compact and cohesive, with only 4 patches without *P. oceanica* in the southern bay of the study area.
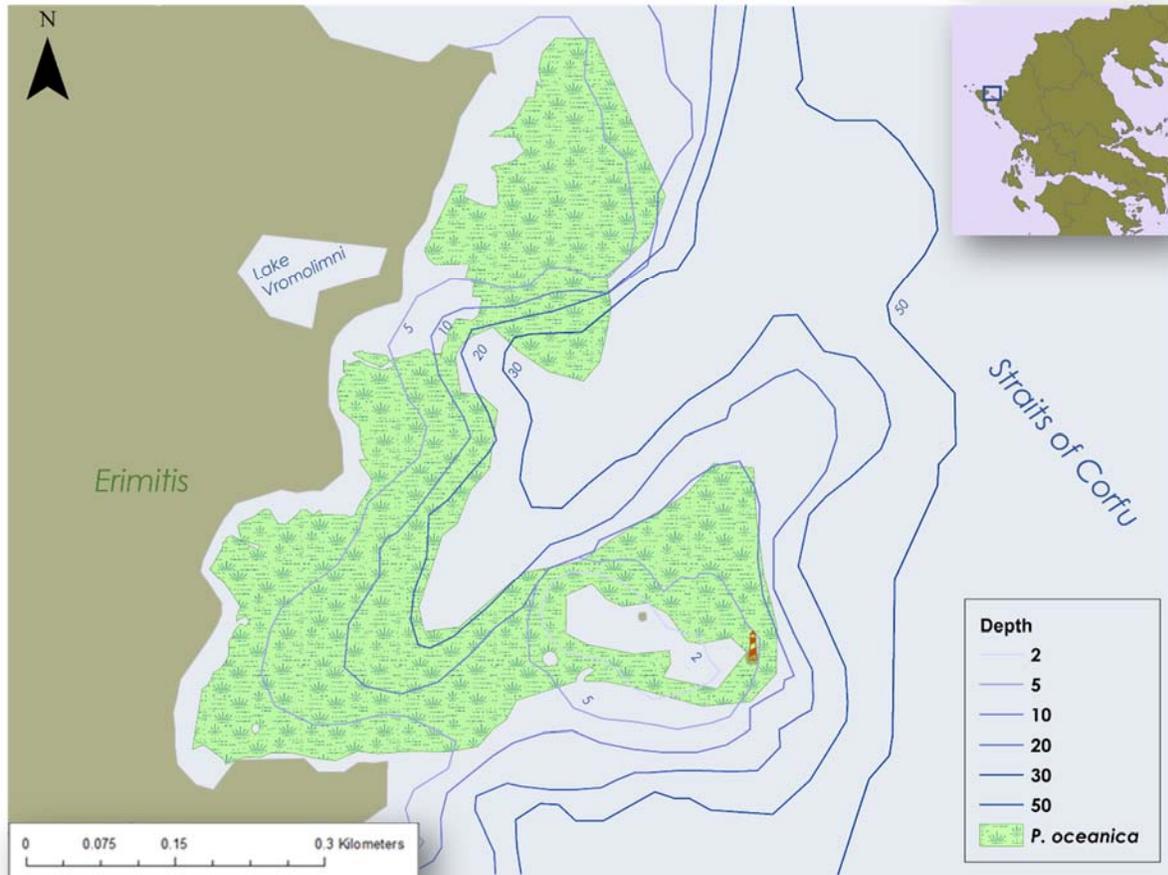
Fig.2: The meadows of Erimitis bay, resulted from the mapping efforts conducted in 2021

Also, the study area is almost intact by anthropogenic disturbances. During 5 days fieldwork, the following activities were recorded in the area:

1)   Fishing with set gill nets and spearfishing,

2)   Recreational activities (swimming and hiking),

3)   Sailing boats and speed boats

Other than the above the area was intact with a completely natural scenery. Species composition was high with 107 species comprising the final list and belonging to 10 different Phyla. Among them the Endangered *Serranus cabrilla*, the Vulnerable *Sciaena umbra* and the Near Threatened *Epinephelus marginatus* were confirmed to occupy the region. It is worth mentioning that no alien species where observed, unlike most parts of the Greek seas, adding to the assumption that the meadow is healthy and intact.

All the above indicate a pristine environment though this assumption was quantified by any means and further research was needed in order to assess the health of the meadow and evaluate the services it provides. For this reason, the team visited the site for a third time in February 2022, to collect root density

data as well as leaf and sediment samples. The main goals of this study is the evaluation of the meadows state and health and the estimation of the total Blue carbon stock that has accumulated in the meadows substrate.

Methodology

Conservation status and health assessment

For the estimation of the ecological status of the area, an index based on the seagrass *Posidonia oceanica* was applied. The *Posidonia oceanica* Rapid Easy Index (PREI) (Gobert et. al., 2009) was utilised, as it has been intercalibrated and has been already used in the East Mediterranean basin (GIG, 2013b). The evaluation of the status of water bodies is based on the use of some organisms or groups of organisms sensitive to anthropogenic pressures: biological quality elements (BQEs). Biological variables indicative of the status of these BQEs should be used for evaluation and monitoring purposes. On this basis, *P. oceanica* was chosen for the Mediterranean area as the angiosperm BQE, as it is considered bioindicator of water quality. The classification of ecological status is based on the deviation of the status of the BQE from its potential status under pristine conditions (reference conditions: RC). This ecological status is expressed using a scale going from 1 (RC) to 0 (worst conditions where the BQE is badly affected or missing). The ratio between the status of a given BQE noted in a station and its status in the reference conditions is called the Ecological Quality Ratio (EQR). The EQR for the *P. oceanica* can be estimated through the calculation of the PREI index (Gobert *et al.* 2009).

The PREI index requires the following five metrics to be collected in the reference depth of 15 meters. These metrics are: a) the depth of the lowest limit (DLM), b) the typology of the lowest limit, c) the shoot density of the plants in a reference frame, d) shoot leaf surface area and e) E/L ratio (epiphytic biomass/leaf biomass). The first three metrics were collected during the field campaign run by iSea's team, while the remaining two were calculated in the laboratory from samples collected from the site.

The depth of the lowest limit was recorded using the dive computer, while the typology is defined as fixed, regressive, or progressive, following the methodology described by Pergent *et. al.*, 1995. Shoot density data were collected at the depth of 15 meters in twenty random frames of 20x20 centimeter size, while from each frame, one shoot has been collected for further analysis in the laboratory.

In the laboratory, for each shoot, the length and width were measured, and the epiphytes were removed from each leaf using a microscope slide. Each shoot along with the epiphytes were placed in an oven to dry at 60°C for at least 48h, until their weight was stabilized. The samples were weighted using a reference scale.

The Leaf Area (LA) is calculated by summing the surface of all leaves from each shoot.

$$LA = LL_1 * LW_1 + \ldots + LL_i * LW_i,$$

where LL- the length of the leaf, LW the width of the leaf and i the number of the leaves of the shoot. LA was calculated for all 20 shoots collected in the field. To estimate the EQR' reference values were utilised that derived from the collected data, while for the ratio E/L, the optimal was set at 0, indicating the absence of epiphytes from the leaves. The EQR' for each site was calculated using the following formula:

$$EQR' = (N_{density} + N_{LA} + N_{(E/L)} + N_{DLM})/3.5,$$

Where:

- $N_{density}$ = (Area value-worst value) / (best value- worst value)
- N_{LA} = (Area value - worst value) / (best value - worst value)
- $N_{(E/L)}$ = (Area value - worst value) / (best value - worst value)
- N_{DLM} = (N'- worst value) / (best value - worst value), where at that calculation the value N'=depth measured in the field + λ, where λ=0 stable limit), λ = 3 (progressive limit) ή λ = -3 (regressive limit).

An EQR value of 0.100 was assigned for the "bad" status boundary; the other EQR boundaries were obtained by dividing the remaining scale (from 0.100 to 1) into four categories of equal amplitude (Table 2) (Gobert *et al.* 2009). The final calculations of the EQR were derived from the equation:

$$EQR = \frac{EQR' + 0.11}{1 + 0.10}$$

Table 2. Ecological status classes based on EQR values for the PREI index.

Ecological status classes	PREI values		
High	0.775	-	1
Good	0.55	-	0.775
Moderate	0.325	-	0.55
Poor	0.1	-	0.325
Bad	0	-	0.099

Apart from the PREI index, the Conservation Index (CI) was also calculated for the study area. In order to collect the necessary data the method of random transects (MRT) was applied at depth of 15m. During the length of each MRT, the diver recorded the dominant seabed cover types closer to them at 1m

intervals. The recorded seabed types were: Seagrass meadows (PO), soft bottom (Sand), dead mate (matte morte). Four MRTs were conducted at random directions and each one had a length of 25m.

The CI can be calculated by the following formula:

$$CI=P/(P+D),$$

where P=% cover *P. oceanica* και D=% cover of dead matte.

The meadow cover (P) and dead meadow cover (D) are calculated as percentage coverages – R%, as follows:

$$R\%=\Sigma(Lx/25*100),$$

where Lχ, is the total calculated length of each seabed cover.

Estimating the total Blue Carbon stock

In order to estimate the total organic carbon stock, the extraction of soil samples is required. A total of 4 core samples were extracted by divers from within the study area using PVC corers. The 4 corers had a length of 60cm and were driven into the sediment between the shoots using a sledgehammer and rotating it for every couple of hits. After each corer reached the maximum possible depth the divers extracted the corer along with the sediment sample. The depth that each corer reached was recorded as well as the height the soil inside the corer, to account for compression. The corers were kept in a dark and cool environment until they were refrigerated, in order to avoid decomposition.

Before the analysis, the samples were placed in an oven at 60°C in order to dry, until a constant weight is reached. After 24 hours, samples were removed from the oven and kept in room with low humidity to cool prior to weighing them. Both the dry and the wet weight were be noted and dry bulk density was calculated as:

$$\text{Dry Bulk Density (g cm}^{-3}) = \text{Dry Weight (g) / Volume of Sample (cm}^{-3})$$

The utilized methodology for estimating the organic content of each sample was the Walkley-Black method (Walkley & Black, 1934). This method is based on the oxidation of organic carbon by potassium dichromate ($2K_2Cr_2O_7$), in the presence of H_2SO_4, according to the reaction:

$$3C + 2K_2Cr_2O_7 + 8H_2SO_4 \rightarrow 2K_2SO_4 + 2Cr_2(SO_4)_3 + 3CO_2 + 8H_2O$$

Potassium dichromate is added to a known excess, so that it is sufficient for the oxidation of organic carbon with some left over surplus. After the oxidation is complete, the quantity of this surplus can be estimated by titration, through a redox reaction with Fe^{2+} in the presence of diphenylamine, according to the reaction:

$$K_2Cr_2O_7 + 6FeSO_4 + 7H_2SO_4 \rightarrow Cr_2(SO_4)_3 + 3Fe_2(SO_4)_3 + K_2SO_4 + 7H_2O$$
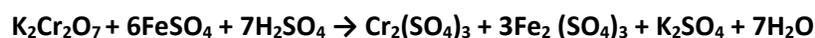
After the titration, the organic carbon in each sample was determined using the equation:

Organic Carbon % (w/w)= (V * (1-V_Δ/V_T) * 0.003 * N * 100) where:

V = The volume (ml) of the solution of $K_2Cr_2O_7$ (1N) that was added.

V_Δ = The volume (ml) of the solution of $FeSO_4$ (0,5 N) that were consumed by the surplus of $K_2Cr_2O_7$ during the titration of the sample

V_T = The volume (ml) of the solution of $FeSO_4$ (0,5 N) that were consumed by 10ml of $K_2Cr_2O_7$ (1 N) during the titration blank test

W = The weight of the sample (g)

The Soil Carbon density for each sample was calculated by using the equation:

Soil carbon density (g/cm^3) = dry bulk density (g/cm^3) * (Organic Carbon % (g)/100)

To obtain the amount of carbon in each corer the following equation was utilised:

Amount carbon in corer (g/cm^3) = Soil carbon density (g/cm^3) * Thickness of the sample inside the corer (cm)

The total core carbon was converted into the units commonly used in carbon stock assessment (tonnes/hectare-cm). The average organic carbon amount (Average C_{org}) and standard deviation (SD) were calculated from the samples. To estimate the total soil carbon stock for the whole area the following equation was utilised:

Total C_{org} (tonnes)= Average C_{org} (tonnes/ha)* Total Meadow Area (ha) ± SD

Results

Conservation status and health assessment

The data show that the meadow has a deep limit of 20 meters and stable typology (figure 3), though in one location in the centre of the meadow the plants exceed the 30 meters bathymetric contour. Shoot density at each sampling site (4 sites at 15 meters depth with 5 frames per site) was between 280 and 385 shoots per square meter. The Conservation Index (CI) was estimated between 0.60 (advanced retreat) and 0.95 (very good status) (Moreno *et al*. 2001), indicating that although the meadows are cohesive in the majority of the areas they cover, some locations saw signs of external pressure that affect this pattern. Nonetheless, the meadows of Erimitis bay were found to be at good ecological status according to the PREI index. The PREI value was calculated at 0.62 which corresponds to an EQR value of 0.66, both falling within the limits of the "Good" ecological status class.
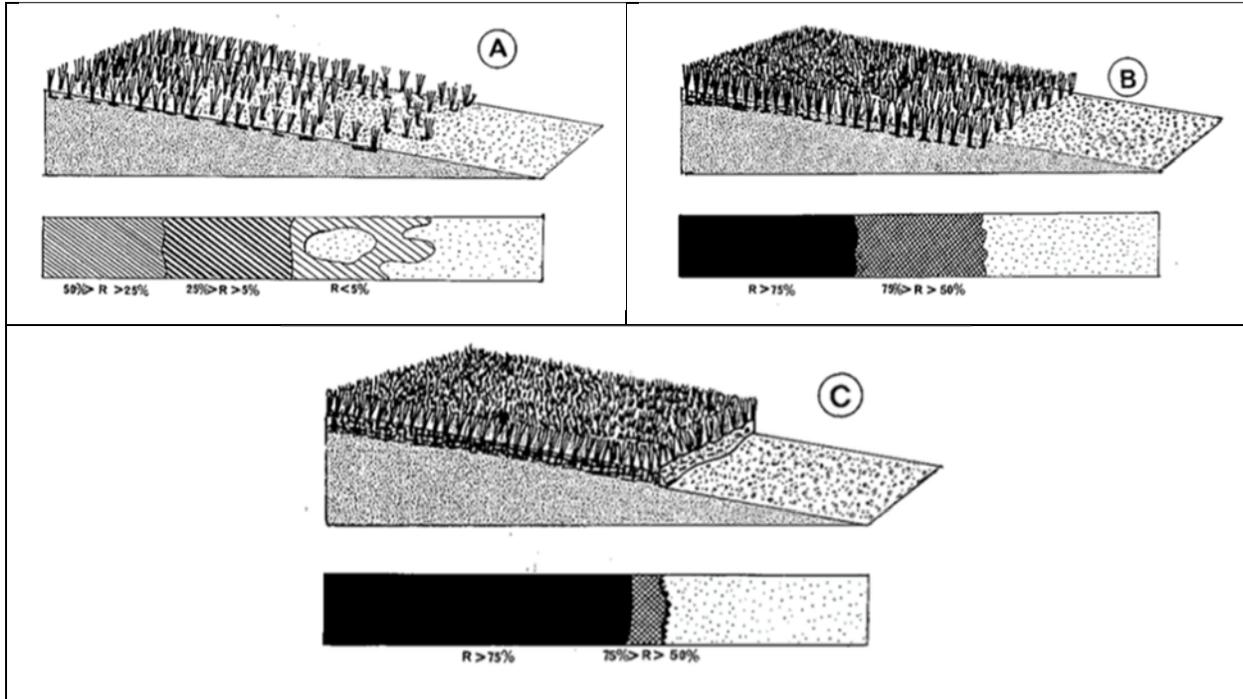
Fig.3: The three types of deep limit. A) progressive limit, B) stable limit and C) regressive. (from Pergent *et al.*, 1995).

Estimating the total blue carbon stock

Four samples of 20ml were extracted for each corer and the dry bulk density for each sample can be found in table 3.

Table 3. The depth and dry bulk density of each corer sampled

Corer ID	Sediment Depth (cm)	Dry Bulk Density (g/cm^3)
ER1	46	0.70
ER2	56	0.77
ER3	51	0.69
ER4	36	0.84

An average of 7.97% the meadows substrate was estimated to be composed of organic carbon. The percentage of organic calculated for each corer can be found in Table 4. The uncertainty from the utilised equipment was estimated to be ± 0.1. The mean organic carbon content for the area was 90.64 tonnes/ha.

Table 4. The organic carbon percentage of each corer

Corer ID	% C_{org} (w/w)
ER1	2.89
ER2	3.01
ER3	3.57
ER4	3.13

The total amount of blue carbon stored in the substrate of Erimitis meadows is 563.85 tC with an estimated SD of $1.864 * 10^{-14}$ for the top 60cm of the substrate, which is equivalent to 35.81 tC/ha.

Discussion /Future steps

Although the state of *P. oceanica* of Northeast Corfu is difficult to assess in their entirety, the meadows located within the study area of Erimitis bay can be considered almost pristine due to a multitude of factors. The upper and lower limits are stable and well defined, and the space between them is covered with healthy and dense shoots, with very few patches of sand, rock or dead plants interrupting their continuity. The lower estimations of the Conservation index (0.6) are likely to be caused by natural processes that can cause fragmentation such as waves, currents and colonization processes (Pace *et al*. 2017) but are also likely to be due to mechanical damage from anchorage of recreational boats as the area receives traffic during the summer. Many organisms inhabit the area and only native species have been observed, with the vast majority of them being associated with *P. oceanica* meadows. The "Good Ecological Status", derived from the PREI index, reflects the stability of the meadows' limits and the good conditions that allow the plants to thrive in the area, such as the clear and unpolluted waters and minimized anthropogenic pressures that affect the area.

The amount of organic carbon stored in the meadows that was assess by this study shows that Erimitis' substrate has stocked 3.58kg per m^2 or 563.85 tonnes. It is important to mention that this amount does not include the entire possible depth of the substrate, which might include additional quantities of accumulated carbon (from 60-100cm). Also, the meadows of the study area extend outside the mapped area, and spread from its northern and southern boundaries. These meadows are not mapped, and no estimation of their blue carbon stock can be made.

To sum up, the study area mostly consists of a healthy and undisturbed meadow, hosting a high number of different species. Since *P. oceanica* meadows are characterized as one of the most productive ecosystems in the Mediterranean, it becomes apparent that the protection of Erimitis bay and the management of its threats and disturbances should be highly prioritized.

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Annex 1

TableA1: The list of the species observed during the biodiversity monitoring, sorted by Phylum. The asterisk (*) indicates data obtained from the survey of E. Papadopoulou in 2020.

Number of species	Species observed	Mediterranean Conservation Status by the IUCN
	Chlorophyta	
1	*Codium fragile*	NE
2	*Codium bursa*	NE
3	*Colpomenia sinuosa*	NE
4	*Cystoceira spp.*	NE
5	*Dasya corymbifera*	NE
6	*Jania rubens*	NE
7	*Liagora viscida*	NE
8	*Lithophyllum incrustans*	NE
	Tracheophyta	
9	*Cymodocea nodosa*	LC
10	*Posidonia oceanica*	LC
	Bryozoa	
11	*Electra posidoniae**	NE
12	*Reptadeonella violacea**	NE
	Porifera	
13	*Hemycale columella*	NE
14	*Crambe crambe*	NE
15	*Aplysina Aerophoba*	NE

16	*Oscarella lobularis*	NE
17	*Petrosia ficiformis*	NE
18	*Chondrosia reniformis*	NE
19	*Ircinia spinosula*	NE
20	*Ircinia spp.*	NE
21	*Chondrilla nucula**	NE
22	*Cliona rickardus**	NE
23	*Cliona schmidti**	NE
24	*Cliona viridis**	NE
25	*Ircinia variabilis**	NE
26	*Sarcotragus spinulosus**	NE
27	*Spirastrella cunctatrix**	NE
	Cnidaria	
28	*Actinia equina*	NE
29	*Anemonia viridis*	LC
30	*Thecocaulus sp.*	NE
31	*Balanophyllia europaea**	LC
	Annelida	
32	*Hermodice carunculata*	NE
33	*Spirorbis spirorbis*	NE
34	*Protula intestinum*	NE
35	*Protula tubularia**	NE
36	*Sabella spallanzanii**	NE
37	*Serpula vermicularis**	NE
	Arthropoda	
38	*Balanus perforatus**	NE
39	*Maja crispata**	NE
40	*Pachygrapsus marmoratus**	NE
	Echinodermata	
41	*Ophioderma longicauda*	NE
42	*Paracentrotus lividus*	NE
43	*Sphaerechinus granularis*	NE
44	*Holothuria forskali*	LC
45	*Echinaster sepositus*	NE
46	*Ophidiaster ophidianus*	NE
47	*Coscinasterias tenuispina*	NE
48	*Arbacia lixula**	NE
	Mollusca	
49	*Lepidochitona cinerea*	NE
50	*Callochiton laevis*	NE

51	*Diadora spp.*	NE
52	*Patella vulgata*	NE
53	*Haliotis tuberculata*	NE
54	*Octopus vulgaris*	LC
55	*Spondylus gaederopus**	NE
56	*Osilinus turbinatus**	NE
57	*Hexaplex trunculus**	NE
	Chordota	
	Tunicata	
58	*Halocynthia papillosa*	NE
	Actinopterygii	
59	*Conger conger*	LC
60	*Muraena helena*	LC
61	*Synodus saurus*	LC
62	*Belone belone*	LC
63	*Atherina boyeri*	LC
64	*Scorpaena scrofa*	LC
65	*Dactylopterus volitans*	LC
66	*Dicentrarchus labrax*	LC
67	*Anthias anthias*	LC
68	*Epinephelus marginatus*	NT
69	*Epinephelus costae*	LC
70	*Serranus cabrilla*	EN
71	*Serranus scriba*	DD
72	*Seriola dumerili*	LC
73	*Apogon imberbis*	LC
74	*Trachinotus ovatus*	LC
75	*Mullus surmuletus*	LC
76	*Sarpa salpa*	LC
77	*Oblada melanura*	LC
78	*Boops boops*	LC
79	*Diplodus annularis*	LC
80	*Diplodus puntazzo*	LC
81	*Diplodus vulgaris*	LC
82	*Diplodus sargus*	LC
83	*Spicara maena*	LC
84	*Chromis chromis*	LC
85	*Mugil cephalus*	LC
86	*Chelon labrosus*	LC
87	*Labrus turdus*	LC

88	Labrus bimaculatus	LC
89	Labrus merula	LC
90	Sparisoma cretense	LC
91	Symphodus ocellatus	LC
92	Symphodus mediterraneus	LC
93	Symphodus tinca	LC
94	Symphodus rostratus	LC
95	Symphodus roissali	LC
96	Thalassoma pavo	LC
97	Coris julis	LC
98	Uranoscopus scaber	LC
99	Tripterygion tripteronotus	LC
100	Parablennius gattorugine	LC
101	Parablennius zvonimiri	LC
102	Gobius luteus	LC
103	Lithognathus mormyrus*	LC
104	Sciaena umbra*	VU
105	Scorpaena notata*	LC
106	Symphodus melanocercus*	LC
107	Tripterygion melanurus*	LC